PREFERRING INNOVATIVE, PROVEN TECHNOLOGIES OVER CURRENTLY USED BASELINE METHODS THROUGH THE INTEGRATED DECONTAMINATION AND DECOMMISSIONING PROJECT[a]

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ABSTRACT

The overall objective of the Accelerated Site Technology Deployment (ASTD) Integrated Decontamination and Decommissioning (ID&D) project is to increase the use of innovative but proven technologies on a large scale in the Decontamination and Decommissioning (D&D) of facilities in the Department of Energy (DOE) complex. The reason for increasing the use of innovative technologies is that each of these technologies has demonstrated improvements over current baseline methods in cost, schedule, waste generation, radiation exposure, or safety. Increased use on a large scale will be accomplished by doing actual D&D projects with the selected innovative technologies, thereby increasing user familiarity and experience with them and adding them to the array of tools available for D&D projects. The novel technologies chosen to be added to the D&D toolbox have all been proven on a smaller scale, either through demonstration in Large Scale Technology Demonstration (LSTD) projects or through commercial use, but they have not been used across the board to decontaminate and decommission facilities in the DOE complex. After completing the project, DOE hopes to see increased use of these technologies that will result in ongoing cost savings at the three participating sites and other sites in the DOE complex.

The ID&D project is a joint effort among the Idaho National Engineering and Environmental Laboratory (INEEL), the Fernald Environmental Management Project (FEMP), and Argonne National Laboratory-East (ANL-E).

I. PROBLEM STATEMENT

Many U.S. DOE sites contain a large number of highly contaminated surplus facilities with various radioactive and hazardous contaminants. These facilities span the range of construction techniques from concrete block to structural steel to massive cast-in-place, steel-reinforced concrete. They often contain large amounts of steel piping and equipment. Many of these facilities need to be decontaminated and decommissioned to free the areas for another use and to reduce the number of facilities requiring maintenance and surveillance. New technologies exist that could decontaminate and decommission these facilities more efficiently than the currently used baseline methods. However, D&D of nuclear facilities includes inherent risks that tend to encourage using methods and technologies that have already been used and proven in the past. As a result, although new technologies have been developed and proven in the DOE's LSTD projects or in commercial use, they have not been used very much to decontaminate and decommission facilities in the DOE complex.

II. OBJECTIVE

The overall objective of this project is to increase using innovative but proven technologies on a large scale in the D&D of facilities in the DOE complex. The selected new technologies are being promoted because they provide reductions in cost, schedule, radiation exposure, or waste volume over the currently used baseline methods. The novel technologies will be used for D&D of selected facilities at the three participating sites. Increasing familiarity with these technologies and showing how successfully they perform during regular D&D operations is expected to increase their use across the DOE complex. In this way, the benefits of reduced cost, schedule, radiation exposure, or waste volume will be seen not only during the ID&D project, but also as ongoing benefits throughout the DOE complex.

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During the ID&D project the three participating sites, INEEL, FEMP, and ANL-E, will integrate their efforts through joint planning and reporting, regular communication, sharing technical information, and sharing lessons earned. Where possible, the equipment will be shared as well.

III. FACILITY SELECTION

Facilities selected for this deployment project present problems typical of decommissioning nuclear facilities throughout the DOE Complex and private industry. Some typical problems associated with facilities are

- Unknown location of high intensity radiation or hot spots
- Unknown location of underground pipes servicing the facility
- Large volume of waste materials
- High levels of radiation resulting in short stay times for workers
- Large amounts of contaminated concrete
- Loose, highly radioactive contamination on surfaces and equipment inside the buildings
- Sizing metal structures and equipment
- Massive high density concrete structures
- High temperatures for workers.

Facilities with some of these problems were selected at INEEL, FEMP, and ANL-E. At FEMP, seven buildings will be decontaminated and decommissioned in Fiscal Year 1998. During Fiscal Year 1999, one building at INEEL and three reactors at ANL-E will be decontaminated and decommissioned. The following is a brief description of each facility:

A. FEMP

At FEMP, seven structures will be decontaminated and decommissioned in Fiscal Year 1998. The structures targeted for D&D under this project represent a cross section of the majority of DOE physical structures. Used for various functions and constructed of various materials, some are constructed of single-story concrete block and others are constructed of multi-story structural steel.

Figure 1 shows one example, Building 38 A, the Propane Storage Building. The structures contain various components including tanks, piping, valves, and material handling equipment. The various structures and internal components create a challenging D&D task. In addition, the structures targeted allow for observing and measuring key D&D parameters that are representative of those at other structures at FEMP and within the DOE complex.

B. INEEL

At INEEL, Test Area North building 616 (TAN-616) will be decontaminated and decommissioned in Fiscal Year 1999. This liquid waste treatment facility (see Figure 2) was constructed in 1958. It operated for 12 years until high contamination prevented repairing increasingly frequent malfunctions. The facility housed a stainless steel evaporator that collected off-gas condensate and evaporator bottoms. The 23 ft tall structure has exterior dimensions of 36 ft × 46 ft and contains several rooms, a basement, an evaporator, numerous pumps and tanks, and miscellaneous equipment. Everything within the building is highly contaminated, and the contamination becomes airborne easily. The building has high radiation levels (18R) that significantly limit worker stay times. Some locations of high intensity radiation are unknown. The building contains metal equipment and piping that must be reduced in size and removed. The building has massive concrete walls (7 ft thick in some areas) with contamination on virtually all of the concrete surfaces. Disposal costs are high, making it desirable to clean or remove the surfaces of the concrete so that the massive structures can be disposed of in a landfill or recycled for road base or other applications. High disposal costs also make it desirable to optimize filling the waste boxes that contain radioactive or hazardous materials. This facility is typical of others within the DOE complex.

C. ANL-E

At ANL-E, the Chicago Zero Power Reactors (ZPRs) and Argonne Thermal Source Reactor (ATSR) facilities will be decontaminated and decommissioned during

Figure 1. Building 38A, the Propane Storage Shelter, is typical of the many small, slightly contaminated buildings at the Fernald Environmental Management Project.

Fiscal Year 1999 and Fiscal Year 2000. The three small test reactors present many of the same technology needs as those at the INEEL, so it is possible that equipment could be shared between the two sites.

IV. TECHNOLOGY SELECTION

The proposed new technologies that address the above problems offer significant improvements over baseline technologies used for previous similar D&D tasks at INEEL, FEMP, and other D&D sites. The chosen innovative technologies have all been proven, either in LSTD projects or commercial use. Each technology has demonstrated improvements over current baseline methods in cost, schedule, waste generation, radiation exposure, or safety.

For example, the currently used baseline technologies for sizing metal structures and equipment include various torches, cutting and sawing techniques. During the ID&D project, the oxy-gasoline torch will be used to cut or segment larger pipes, equipment, or structural components in the facilities. The oxy-gasoline torch has demonstrated superior performance in speed, safety, and cost. It cuts large, heavy metal objects significantly faster than the baseline cutting devices and significantly improves safety performance by eliminating burning metal slag blow through. The oxy-gasoline torch is less expensive to operate than conventional torch cutting equipment because of the less expensive fuel. The oxy-gasoline torch provides reductions in cost and schedule (and thus, radiation exposure), and improvements in safety.

Table 1 presents a summary of the D&D need areas, baseline technologies, and selected improved technologies. Additional details about the improved technologies, including suppliers and demonstration locations are presented in Table 2.

V. APPROACH

The ID&D project will be conducted in three phases. During the first phase, qualification, we selected and

Figure 2. Building TAN-616 at the Idaho National Engineering and Environmental Laboratory has problems typical of many excess structures in the DOE complex.

Table 1. Baseline and New Technologies.

Problem Area	Baseline Technology	New Technology
Unknown Location of Hot Spots	Manual survey	Gamma Cam
Unknown Piping Locations	Exploratory digging	Pipe Explorer
Large Volume of Waste	Unplanned filling of waste boxes by hand	Decontamination, Decommissioning, and Remediation Optimal Planning System (DDROPS)
High Levels of Radiation	Reduced stay times	Remote operations
Contaminated Concrete	Hand-held scabblers	Brokk demolition robot with scabbler
Loose Contamination	Vacuuming or washing	Strippable Coating applied with Brokk
Sizing of Metal Equipment	Acetylene torch, saws	Oxy-gasoline Torch, Hand-held shears, Brokk with shears, Tire Mounted Shear/Crusher, Track Mounted Shear/Grapple
Massive Concrete Structures	Jack hammering, diamond wire sawing	Track Mounted Shear/Crusher and Tire Mounted Shear/Grappler
Cooling Radiation Workers	Reduced stay times or ice vests	PICS cool suits

Table 2. Selected Technologies.

Technology	Supplier	Large Scale Technology Demonstration Location	ID&D Location	Function	Expected Benefit Areas
Gamma Cam	AIL Systems, Inc.	FEMP, Chicago CP-5	INEEL, ANL-E	Remote radiation survey	Radiation Exposure
Pipe Explorer	Science and Engineering Associates, Inc.	FEMP, Chicago CP-5	ANL-E	Characterize and locate pipes	Radiation Exposure, Safety
Decontamination, Decommissioning, and Remediation Optimal Planning System (DDROPS)	INEEL	Scheduled for Fiscal Year 1998	INEEL, ANL-E	Optimize cutting, filling waste boxes and create inventory database	Cost, Schedule, Radiation Exposure, Waste Volume, Safety
Brokk w/scabbler, shears, hammer, gripper, grapple	Brokk Holmhed Systems AB, Sweden	Chicago CP-5, Connecticut Yankee D&D	INEEL, ANL-E	Remote excavation with tether or radio remote control. Deploy other tools remotely	Cost, Radiation Exposure, Safety
Oxy-gasoline Torch	Petrogen International, LTD	FEMP	FEMP, INEEL, ANL-E	Cut carbon steel faster and cheaper	Cost, Schedule, Radiation Exposure, Safety
Hand-Held Shears	Lucas Rescue Tools, Inc.	Hanford	FEMP, INEEL, ANL-E	Cut metal in remote locations	Cost, Radiation Exposure
Track Mounted Shear/Crusher	La Bounty & Tiger Manufacturing	Industry	FEMP	Remote demolition and cutting	Cost, Schedule, Radiation Exposure, Safety
Tire Mounted Shear/Grapple	Eagletech	Industry	FEMP	Remote cutting and manipulation of pieces of waste	Cost, Schedule, Radiation Exposure, Safety
Personal Ice Cooling System (PICS) cool suit	Delta Teemax, Inc. and Geomet Technologies	FEMP	FEMP, INEEL, ANL-E	Keep radiation workers cool	Cost, Schedule, Radiation Exposure, Safety

procured innovative but proven D&D technologies and we selected facilities. The selected technologies have a high potential for benefit in the areas of cost, schedule, waste generation, radiation exposure, or safety. In the second phase, implementation, we will use these technologies to decontaminate and decommission one facility at INEEL and one facility at FEMP. During the last phase, deployment, we will deploy the technologies at additional facilities at the three sites and send information about the technologies to other potential deployment sites.

VI. STAKEHOLDER AND REGULATORY APPROVAL

INEEL, FEMP and ANL-E have a demonstrated history of integrating regulators, stakeholders, and tribes to obtain approval and permits for environmental management projects similar to the D&D activities that will be performed in the ID&D project. The existing stakeholder and regulatory approach ensures that all regulators, stakeholders, and tribes are active participants in planning and implementing programs that affect them. Accelerated regulatory approval for the ID&D projects is expected through inter-state reciprocity.

VII. EXPECTED BENEFITS

The primary benefit expected of the ID&D project is that these novel technologies will become more widely used throughout the DOE complex, creating savings in many DOE operations. Completing the D&D of the selected facilities during the ID&D project should result in cost savings, accelerated schedule, reduced radiation exposure and waste volume, and increased safety at INEEL, FEMP and ANL-E. These same savings should be seen when the innovative technologies are used to decontaminate and decommission other facilities at these sites. Most of all, similar savings should be seen as use of these innovative technologies becomes widespread throughout the DOE complex.

VIII. SUMMARY

The overall goal of the ID&D project is to increase the use of innovative, proven technologies over currently used baseline methods within the DOE complex. This is necessary because new technologies exist that can provide improvements over baseline methods in cost, schedule, radiation exposure, waste volume, or safety. During the ID&D project, technologies that have been proven during the LSTD projects or during commercial use will be used to perform D&D operations on facilities at the three participating sites. Besides providing benefits to these sites, this project is expected to increase use of these technologies throughout the DOE complex by increasing experience and familiarity with the selected innovative technologies. After completing the project, any additional D&D work using these technologies should result in further cost savings for INEEL, FEMP, and ANL-E or other sites within the DOE complex.

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